A convenient method of proving the above is as follows: Darken the experimental room slightly by closing the windows, but leave a crack between the shutters, showing a strip of bright sky. Now gaze with *one* eye, say the right, on the crack until its image is branded on the retina. If we now turn about and look at the wall in various directions the after-image, of course, follows all the motions of the eye. Even if we shut the eye and look about the field of darkness the after-image follows all the motions of the eye. But if, with eyes still shut and looking straight in front, without changing the direction of looking, we press in the external corner of the branded eye the after-image does not move. It still remains directly in front.

We have given this experiment as most convenient, but we may use a retinal brand produced by the setting sun with still more conspicuous results.

One more experiment to show the behavior of after-images in the movements of the eye. Gaze with *both* eyes on the crack of the previous experiment, until its image is strongly banded on the vertical meridian of both retinæ. On turning about and looking at the wall the after-image is distinctly seen and follows with exactness all the motions of the eyes in looking about. But now *converge* the eyes until they look at the root of the nose. Of course, each eye changes its direction at least forty-five degrees, but the direction of the after-image does not change. It is still directly in front. The reason is that, while each eye *individually* changes its direction, the binocular observer looks in the same direction, though at a nearer point. The two external images of the retinal brands cannot separate, as the images of an object do, because the brands are on corresponding points and have the same spatial representative and, therefore, must be seen single. This is the reason, as I have fully explained in my volume 'Sight,' pp. 199 and 200, why after-images cannot be used to test the motions of the eyes by rotation on the optic axis in *convergence*, although they are such accurate tests in *parallel motion*.

Joseph Le Conte.

Berkeley, Cal., July 29, 1897.

SCIENTIFIC LITERATURE.

Leitfaden der Praktischen Physik, mit einem Anhange, Das absolute Maas-system. Von F. Kohlrausch. Achte Auflage, B. G. Teubner, Leipzig.

Each new edition of this book has been characterized by such considerable additions that the modest guide to elementary laboratory work in physics, which first appeared under this title more than twenty-five years ago, has become a reference volume of some five hundred pages, as valuable to the advanced worker as to the beginner.

A laboratory manual should cover the entire field without undue specialization in any one direction, and without any omissions. Kohlrausch's book does this for physics more satisfactorily than any other. In fact, the manuals edited in America are too evidently, and often avowedly, nothing more than a compilation from the course given at the particular institution at which the author is teaching, and hence possess all the peculiarities and limitations of the work at that laboratory, and too often are of slight value elsewhere, with different conditions and facilities.

Kohlrausch sets forth not what is done at Würzburg or Strasburg, or even at Berlin, but what ought to be done under ideal conditions in a complete laboratory. The book is a guide to the instructor as to what experiments should be performed, as well as to the student as to how they are to be performed.

As regards the explanation of the operations, the author seems to have followed most successfully the principle laid down in the preface to this edition, "to carry the scheme, the explanation, and the setting-up of the apparatus for an experiment no further than is rendered necessary for the successful operation of a laboratory attended by a large number of students." He has achieved the happy mean between allowing the pupil to flounder too long in the working out of an experiment, and giving him such minute instructions that the necessity for originality of thought on his part is entirely eliminated.

It is difficult to select parts of this book as worthy of special mention, and yet certain subjects are treated in a manner in especially

agreeable contrast to that found in similar manuals. The calculation of corrections and the discussion of the effect of the errors of observation upon the result, as well as the methods of least squares and of approximation, will be found particularly clear, complete and useful. Indeed, much of the unique value of the book lies in its many suggestions as to simple manipulative methods, receipts and general good advice. It is these little 'tricks of the trade' that distinguish the successful experimental investigator from the helpless theorizer.

The body of the book contains concise, clear instructions for the determination of about every quantity that may be of interest to the experimental physicist, together with numerous demonstrations and illustrative examples. An excellent feature of this part is the frequent reference to the original investigations from which the methods were derived.

The absolute system of units is happily not the novelty to-day that it was when Kohlrausch introduced it into the Leitfaden; nevertheless his clear and complete exposition of its principles, its units and their values is very acceptable even now, and gives in some twenty pages the essentials of the whole matter.

The thirty pages of carefully selected tables form a very agreeable and striking contrast to some similar books recently offered in this country.

Some teachers have lamented the absence of pictures of instruments, but it would appear inconsistent with the general nature of the book if specific pieces of apparatus were represented. It is better and probably easier for a pupil to specialize from a diagram to any corresponding instrument than from one instrument to another of radically different appearance, though similar in principle.

The English translation of the last edition of Kohlrausch is very good, but not so good as the original because the translator has permitted himself to make changes.

A Systematic Treatise on Electrical Measurements. By HERSCHEL C. PARKER. Spon & Chamberlain, London and New York.

Mr. Parker, confining himself to a smaller field, and rather to the technical than the theoretical aspect of the subject, has succeeded in following the good example of Kohlrausch and sets forth what such a course should teach, rather than what is taught under the conditions at Columbia.

Particularly valuable is the strictly systematic way in which the subject is treated, enabling the student to see at a glance the relative merits of different instruments and methods for the various measurements of the same class, and to choose the apparatus and method best adapted to his particular determination. Although giving the principle and construction of the latest forms of electrical measuring instruments, the author has done better than some others, who could not resist the temptation to use old cuts or introduce trade pictures of apparatus. His diagrams and outline cuts show the fundamental parts most satisfactorily and enable the reader easily to imagine the brass and hard-rubber accompaniments. The book is sure to be useful to the electrical engineer, as well as to the investigator, who will gladly welcome future editions with the revision and additions which the author seems to feel desirable.

WILLIAM HALLOCK.

Bibliography—A Study of Resources. CHARLES SEDGWICK MINOT. In *Biological Lectures delivered at the Marine Biological Laboratory of Wood's Holl in the summer session of 1895.* Boston, Ginn & Company. 1896. P. 149–168.

Short surveys of the present standpoint of bibliography from the point of view of the special sciences should prove advantageous both for the specialist and for the bibliographer. To the former such surveys would be mainly useful in giving him a systematic guide through the mass of publications which he must work over to find the particular literature needed for his investigations. To the latter—I am here thinking especially of the librarian—they would make plain the connection of bibliography with the special sciences of which bibliography is the handmaid. Professor Minot's account of biological bibliographical literature is a good example of what such a survey should be. He does not drown his subject in enumeration of details, but describes and considers the main